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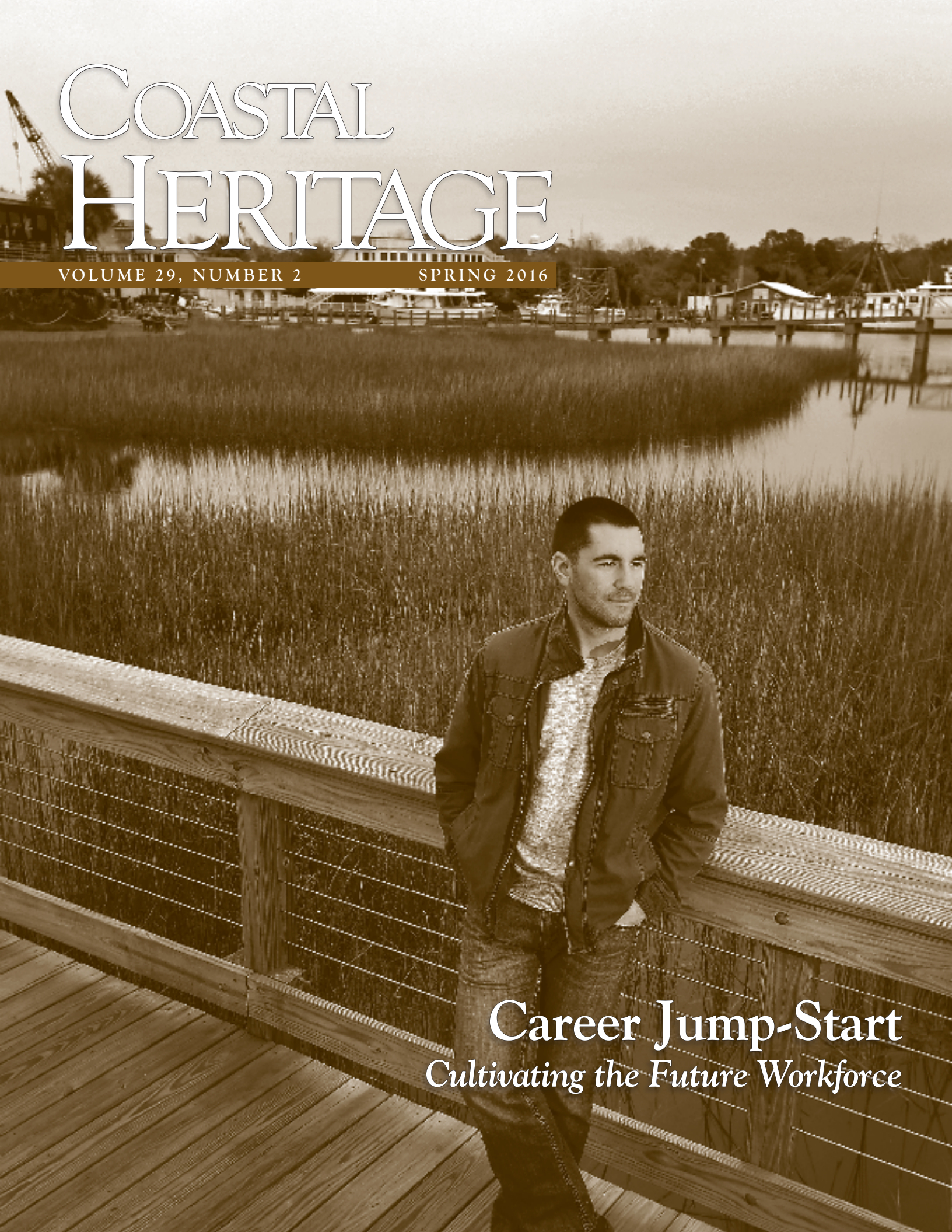

Career Jump-Start

Cultivating the Future Workforce

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Dear Readers,

With this issue we say farewell to John H. Tibbetts, long-time writer and editor of *Coastal Heritage*. The Winter 1990 issue "Climate Change: Implications for South Carolina" was John's first as editor. Since then, he has written about a variety of topics, from the search for the first Americans and Colonial-era naturalists to coastal development and the Gullah/Geechee culture. John had a special talent for identifying important issues—past, present, and future—and explaining them in an eloquent, yet understandable, way. The S.C. Sea Grant Consortium and the State of South Carolina are grateful for his dedicated service of nearly 26 years.

I would also like to take this opportunity to introduce Joey Holleman as our new writer and editor. Joey previously worked at *The State* newspaper in Columbia, S.C., where he covered environmental issues, health care, outdoor recreation, weather-related topics, and cultural heritage. Joey's roots are in the Lowcountry and he is excited to be back in Charleston, working for the Consortium and enjoying the area's recreational amenities. We are delighted to have Joey on-board to bring you stories about South Carolina's working waterfronts, coastal flooding, the impact of the Reconstruction era, and many more interesting issues in the years to come. —Susan Ferris Hill, director of Communications

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Coastal Heritage is a quarterly publication of the S.C. Sea Grant Consortium, a university-based network supporting research, education, and outreach to conserve coastal resources and enhance economic opportunity for the people of South Carolina. Comments regarding this or future issues of ***Coastal Heritage*** are welcomed at Joey.Holleman@scseagrant.org. Subscriptions are free upon request by contacting:

S.C. Sea Grant Consortium
287 Meeting Street
Charleston, S.C. 29401
phone: (843) 953-2078
e-mail: Annette.Dunmeyer@scseagrant.org

Executive Director
M. Richard DeVoe

Director of Communications
Susan Ferris Hill

Editor
Joey Holleman

Art Director
Pam Hesse
Pam Hesse Graphic Design

NEXT GENERATION SCIENTIST. *Researchers from the University of South Carolina mentor a S.C. Sea Grant-supported graduate student, making him better prepared to enter the workforce.*
PHOTO/SUSAN FERRIS HILL/S.C. SEA GRANT CONSORTIUM

Career Jump-Start

Cultivating the Future Workforce

Smart, industrious, and well-trained people establish the foundation for research, education, and outreach programs supported by the S.C. Sea Grant Consortium.

Those people don't just fall out of the sky. They need to be identified, encouraged, and nurtured. The Consortium's many fellowships and internships have boosted hundreds of students for the past 35 years. Even more future scientists and leaders have honed their skills and found their callings while working as graduate students on Consortium-funded projects.

National programs such as Sea Grant's John A. Knauss Marine Policy Fellowship and the National Oceanic and Atmospheric Administration's Coastal Management Fellowship are at the top of the workforce-training ladder. The Knauss fellowship program, named for one of Sea Grant's founders, selects candidates nominated by the 33 state Sea Grant programs to spend a year in the nation's capital working for federal agencies and congressional staff offices. Coastal Management fellows earn on-the-job training working on projects, such as planning for sea-level rise and creating decision-support tools for sustainable growth.

Fueling the future through workforce development always has been among the Consortium's key goals.

- Nearly 1,000 undergraduate and graduate students have worked on Consortium-funded projects with an average of about 40 per year in the past decade.
- Forty-five Consortium nominees have been selected as Knauss fellows since 1979.
- Fifteen Consortium nominees have been selected as Coastal Management fellows since 1997.

Workforce development is even more important now because over half of the marine-related workforce is eligible for retirement in the next five years. Also, the need for well-trained professionals to plot the future has ramped up with the emergence of new marine technologies and discoveries, and the increasing pressure on coastal and ocean resources as human populations increase and more people move to the coast.

The Consortium starts early by helping educators design improved K-12 marine curricula, by creating specialized professional development programs such as the "From Seeds to Shoreline" teacher training effort, and by showcasing how rewarding marine, coastal, and natural resources careers can be at events such as the Charleston Science Technology Engineering and Math (STEM) Festival.

Ideally, those K-12 students with the right mix of passion and intelligence move on to college undergraduate and graduate programs and benefit from Consortium research and fellowship opportunities. And that primes them for important careers like the seven researchers and educators profiled in the coming pages, each of whom got a boost from Consortium-funded projects.

— Joey Holleman

Making a coastal planning connection: M. Grant Cunningham

CULTURAL PRESERVATIONIST. ***Grant Cunningham, a 1989 Knauss fellow, combined several of his areas of expertise for a project in which Clemson University architecture students helped the Pendleton Foundation for Black History and Culture preserve this historic Keese Barn site in Pendleton, S.C.***
PHOTO/CLEMSON UNIVERSITY

In the summer of 1987, M. Grant Cunningham headed to the South Carolina coast to compile data for a new *South Carolina Public Beach & Coastal Access Guide*. The experience changed his life.

With undergraduate degrees in English and history from Duke University and a M.A. in journalism from the University of South Carolina, Cunningham was a Ph.D. student at Clemson University in the Parks, Recreation, and Tourism Management program when his assistantship sent him to the coast to work on the guidebook. At the time, he hadn't visited the coast often—only two or three trips in his life—and he didn't know much first-hand about beaches.

That summer, as he gathered data from the state's six coastal waterfront counties, he fell in love with the region. Currently an associate professor at Clemson's College of Architecture, Arts, and Humanities, Cunningham teaches coastal management in the master's degree program on city and regional planning. He says he owes much of his career success to that summer of 1987 and his experience with the S.C. Sea Grant Consortium.

Consortium leadership saw Cunningham's potential and brought him on as an intern. From May 1988 to January 1989, Cunningham tracked research projects, assisted with community forums, and conducted a beach-access demand study.

"Having an opportunity to come to Sea Grant and learn a lot more about coastal issues and meet other coastal professionals—I couldn't ask for more as a graduate student," Cunningham says. "I had the chance to meet people from every level of government. I began to understand the structure, from local to state to federal government, and the mix of agencies and players within the coastal management agencies. Now, I make sure my students understand that management structure and the people involved."

Cunningham was chosen as a Knauss fellow in 1989 and served on the staff of the Senate Commerce, Science, and Transportation Subcommittee on National Ocean Policy Study, chaired by Senator Ernest F. Hollings. He prepared Senator Hollings' opening statements, organized hearings, and drafted legislation for the subcommittee. After the fellowship, Cunningham was hired to continue his work as a professional staffer on the committee in 1990.

"As a Knauss fellow, I got a better grasp of the philosophy behind the development of the coastal zone management program," he says. "I became more knowledgeable about policy development and understood more about the program's 'carrot and stick' approach."

Robert Becker, a professor emeritus and former director of the Strom Thurmond Institute of Government Affairs at Clemson was one of Cunningham's mentors, and he saw Cunningham's growth during that period. "He was asking 'Why are we having to do all this jumping through hoops when everything gets approved?' He asked important policy questions," Becker says.

In early 1991, Cunningham returned to South Carolina for a new position created at Clemson University: research associate and director of the South Carolina Rural

As a graduate student at Clemson University in 1987, Cunningham was introduced to coastal issues when he helped gather information for the publication **South Carolina Public Beach & Coastal Access Guide.**
PHOTO/GRACE BEAHM

Recreation Development Project, a start-up program working with rural communities to develop full-time recreational programs and services. After earning his doctorate in 1995, he's now an associate professor with Clemson's College of Architecture, Arts, and Humanities. He is still involved with coastal planning, as well as outdoor recreation resource management, community development, housing, and travel and tourism.

At many stages in his career, he received advice and support from the Consortium. "Basically, the people at Sea Grant said to me, 'What are you interested in? And what can we do to make that happen?'" Cunningham says.

"I've been teaching 21 years, and I have made so many connections—local, state, federal, and non-profit groups. When I have taken my students to various meetings on the coast, they are amazed by all the connections I have. That's what Sea Grant did for me. It helped me make those connections."

— John H. Tibbetts

M. GRANT CUNNINGHAM

B.A., English and History, Duke University, 1979

M.A., Journalism, University of South Carolina, 1985

Ph.D., Parks, Recreation, and Tourism Management, Clemson University, 1995

First post-graduate job: Research Associate, Clemson University, Parks, Recreation, and Tourism Management

Current job: Associate Professor, Clemson University, College of Architecture, Arts, and Humanities

Sea Grant connection: Worked as Consortium graduate student intern, 1988; Knauss fellowship, 1989.

Learning job skills while building species research: Rachel Kalisperis

ANIMAL CARETAKER. *Rachel Kalisperis' work on a S.C. Sea Grant Consortium-funded oyster habitat study in the 1990s led to a job at the South Carolina Aquarium, where she now is director of husbandry.*
PHOTO/GRACE BEAHM

Rachel Kalisperis remembers the first time she visited a lowcountry oyster reef in 1996. As a graduate student in marine biology at the College of Charleston, she often did field sampling for a S.C. Sea Grant Consortium study on oyster ecology. But what she remembers best about her early research experience was that first trip by boat into a quiet stretch of estuary where tidal creeks twist and turn through giant salt marshes.

"It was both peaceful and full of life," says Kalisperis, now director of husbandry at the South Carolina Aquarium in Charleston, S.C. "I felt content, as if this were the place I was meant to be."

Growing up in coastal New Jersey, she often played on the beach and in salt marshes.

"My time with South Carolina's oyster reefs," Kalisperis says, "reminded me of my time in New Jersey's salt marshes. The biodiversity in both rivals that of coral reefs and is just as beautiful."

In New Jersey, the Eastern oyster (*Crassostrea virginica*) spends its entire life under water. It is subtidal in estuaries from Chesapeake Bay to New England.

In South Carolina, by contrast, 95% of the oyster reefs by acreage are intertidal—under water at high tide but exposed to the air at low tide. South Carolina oyster reefs are different in another way: They are in reasonable abundance and good harvesting condition compared to many other regions around the nation and the world.

In the late 1990s, Kalisperis worked as a research assistant to Loren Coen, a marine scientist who was then at S.C. Department of Natural Resources and is now an affiliate research professor at Florida Atlantic University. Coen and his team were working on a 10-year, Consortium-funded study, which established that lowcountry intertidal oyster reefs provide essential habitat for many species of finfish and invertebrates such as crab and shrimp.

Kalisperis became deeply involved in the research process with extensive field sampling, data entry and analysis,

Kalisperis supervises the South Carolina Aquarium's animal care staff, which handles everything from ocean fish in the big tank to reptiles, amphibians, mammals, and birds in other displays.
PHOTO/GRACE BEAHM

sorting and identification of fish and invertebrates, and preparation of scientific presentations. She also assisted on other efforts such as clam mariculture and gag grouper research. Her experience with so many different technical tools and in scientific investigations became crucial to her education and training.

"Rachel came to me having experience working in New Jersey with a public aquarium there prior to coming to the College of Charleston," says Coen. "She had confidence but needed to gather more experience in marine science and related fields, and then field efforts complementing her research with oyster populations."

While working on the project, Kalisperis began volunteering at the holding facility the South Carolina Aquarium used to house animals before it opened in 2000. "With all the stress of working on a thesis, that was my mental break to go down there on Saturday morning and get close to the animals," she says.

Before she finished her thesis work, the perfect job opened up at the aquarium. "They were looking for someone to take care of the oyster reef exhibit," Kalisperis says. "They needed someone who knew which species to put in the exhibit, what they would eat, and eventually create a species plan for the exhibit."

Sixteen years later as the aquarium's director of husbandry, she's in charge of the people who perform those tasks for all of the animals.

"My graduate research helped me tremendously," she says of getting her first position at the aquarium. "It was really because of my S.C. Sea Grant-funded research experience with Loren that I was able to do that job."

— John H. Tibbetts

RACHEL KALISPERIS

B.S., Biology, Drew University, 1994

M.S., Marine Biology, College of Charleston, 1999

First post-graduate job: Aquarist, South Carolina Aquarium

Current job: Director of Husbandry, South Carolina Aquarium

Sea Grant connection: Worked on Consortium-funded graduate project on oyster reefs.

Getting to the core of climate change through carbon: Kathy Tedesco

CLIMATE SCIENCE LEADER. ***Kathy Tedesco took advantage of a 2002 Knauss fellowship to transition her burgeoning interest in carbon-based climate research into a role that helps inform national and international policymakers.***
PHOTO/NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Kathy Tedesco had an impressive background in long-term climate studies before she earned a Knauss fellowship in 2002, and her work during the fellowship primed her to become an international leader in the field.

Tedesco was finishing work on her doctorate at the University of South Carolina (USC) when she was selected for the fellowship. Her research focused on the last 6,000 years of climate history of the tropics, working with USC researcher Robert Thunell on a study of core samples from the Cariaco Basin of the Caribbean off Venezuela.

The water in the Cariaco Basin has low dissolved oxygen levels and high sedimentation rates, and the basin is located where weather conditions along the Intertropical Convergence Zone are especially variable. In other words, it has the ideal setup for studying climate changes through sediment core samples.

Tedesco studied microscopic,

Tedesco's graduate work at the University of South Carolina involved studying ocean sediment core samples pulled onto ships in the Caribbean in rosette devices like this one.
PHOTO/NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

single-cell organisms called planktonic foraminifera. These tiny creatures are one of the building blocks of ancient climatology research because they make their shells using what's available in the water around them, and when they die the exoskeletons sink to the sea floor. The composition of the foraminifera shells in a certain layer of a core sample can help determine the water temperature and salinity, among other things, when that layer was deposited on the ocean bottom thousands of years ago.

Focusing on three particular species of planktonic foraminifera, Tedesco detailed at least four major decreases in sea-surface temperature and/or increases in salinity in the past 4,000 years. Those results were compared with other records from the region, including levels at Lake Titicaca, to help build a climatologic history for the Cariaco Basin, the Caribbean region, and the tropics during the late Holocene period.

Core samples of basin sediment also revealed the level of carbon in the ocean and the atmosphere through the centuries. The volumes of research on ice sheet and ocean bottom cores made it clear there have been several peaks in atmospheric-carbon levels through the planet's history. They also indicated the current rise is unprecedented in its speed and lack of a link to factors such as orbital changes that influenced other high-carbon periods.

Tedesco earned her undergraduate degree in geology at the State University of New York—Stony Brook and her M.S. from the University of Colorado in geological oceanography. Her master's work in paleoceanography looked at fluctuations in the Laurentide Ice Sheet over the last 45,000 years based on marine sediment cores from the Northwest Labrador Sea.

Her interests began to shift from lab and field work to policy and management while earning a doctorate at USC, and that change took flight during her year as a Knauss fellow.

Since then, Tedesco has served as program manager for the Global Carbon Cycle Program in the National Oceanic and Atmospheric Administration (NOAA) Climate Program Office in Silver Spring, Md.; worked on another sediment study in the Gulf of Mexico in St. Petersburg, Fla.; and served as director of the International Ocean Carbon Coordination Project with the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in Paris.

She's been program manager for Ocean Climate Observation within NOAA's Climate Program Office since 2014, working with researchers and representatives of U.S. federal agencies. The two major initiatives she's working on are the North American Carbon Program and the Ocean Carbon and Biogeochemistry Program.

The Cariaco work piqued her interest in carbon observation, and, when she moved on to NOAA, a carbon-focused job opening appealed to her. "And carbon has been my life ever since," she says.

With the importance of carbon studies growing, Tedesco loves that what she's doing is having an impact.

"The work with the international community and my current post," she says, "is critical to our understanding of the role of the ocean as a sink for carbon dioxide, a greenhouse gas responsible for global climate change and acidification of the ocean, and how cycling among carbon reservoirs varies on seasonal-to-decadal time scales."

Thunell says he told Tedesco during her time at USC that if she really wanted to go into the policy side of climate work, the Knauss fellowship "is a vehicle that can get you started, and Kathy would not be doing what she's doing today if she hadn't gotten that Knauss fellowship."

— Joey Holleman

KATHY TEDESCO

B.S., Geology, State University of New York—Stony Brook, 1986

M.S., Geological Oceanography, University of Colorado, 1993

Ph.D., Geological Oceanography, University of South Carolina, 2002

First post-graduate job: Program Manager, Global Carbon Cycle Program, National Oceanic and Atmospheric Administration

Current job: Program Manager, Ocean Climate Observation, National Oceanic and Atmospheric Administration

Sea Grant connection: Knauss fellowship, 2002.

Opening doors that lead to shell-making discovery: Andrew S. Mount

CELLULAR EXPERT. ***Andrew Mount, who served as a graduate student intern with the S.C. Sea Grant Consortium in the 1980s, now teaches Clemson University students who are exploring marine larvae sections displayed on a Sutter Movable Objective multi-photon microscope.***
PHOTO/CLEMSON UNIVERSITY

How do oysters make their sturdy shells?

Andrew S. Mount has been intrigued by that question throughout his scientific career, which began in earnest at the Graduate Program in Marine Biology at the College of Charleston. He joined the S.C. Sea Grant Consortium as a graduate student intern in 1986.

For more than three decades, Mount has sought to understand how oysters—those fleshy, tasty, and surprisingly complex creatures—build their protective shell that is their first line of defense from parasitic infections and predators. How do oysters turn ordinary seawater ingredients into hardened minerals that are sturdy, tough, and long-lasting?

Now a marine cellular and molecular biologist at Clemson University, Mount has become known as the scientist who discovered a new kind of cell that enables the oyster to make the shell-forming calcium carbonate crystals by intracellular mechanisms. Mount also founded and manages the Okeanos Research Laboratory at Clemson, which conducts research on oyster formation, marine biofouling, and ocean acidification. He credits the Consortium, which also helped fund a component of the Okeanos lab, for his success as a scientist.

"I never could have made it as a scientist without Sea Grant," he says. "The economics of graduate school at the College of Charleston wouldn't have worked without the job at Sea Grant. That's also where I learned so much by participating. I learned the importance of listening skills—how to bring a lot of people with disparate interests into a room and really listen to them, and then develop action plans. I learned how to have an open-minded, collaborative style of management. I learned how to have an open-door policy. Now the door at my lab is always open."

In August 1989, Mount began doctoral studies at Clemson University, continuing his biochemical studies on oyster shells and earning a research assistantship supported by the Consortium. A year after obtaining his doctorate, he was hired by Clemson as a post-doctoral scholar for his growing expertise in optics. He helped to manage the college's first laser scanning confocal microscope and later established an optical biological imaging core laboratory.

His skill with imaging technology eventually enabled him to see something no one had noticed before. Certain oyster cells, he discovered, were tiny factories that produced the building blocks of shell formation.

Traditional theory says the oyster creates its shell-building crystals outside of cells. That is, the oyster excretes a special molecular substance to the outer layer of the animal's fleshy surface or "skin." This special substance, in turn, captures the necessary ingredients from seawater—such as carbon and calcium—and synthesizes them into calcium carbonate crystals, the stuff of oyster shells.

But Mount and his research team saw a different crystal-building process at work. The team located specialized blood cells that capture essential ingredients and synthesize calcium carbonate crystals, shipping them out to the shells to build or repair them.

That means oyster shell formation is a cellular process and independent of the external seawater environment. This is good news for the oyster

One of Mount's breakthrough discoveries involved unlocking the cellular process oysters use to create their hard, layered shells.
PHOTO/CLEMSON UNIVERSITY

industry, as it makes oysters more resistant to ocean acidification than previously thought.

Mount and his team's breakthrough in oyster cell biology was published in the prestigious journal *Science* in April 2004. He participated with other co-authors in a Genome Institute effort that revealed the complete genetic blueprint of the Pacific oyster (*Crassostrea gigas*) in the equally prestigious journal *Nature* in 2012. The genome project highlighted the complexity of oysters, which express more genes than humans.

These two papers established the foundation for a cellular-based mechanism of shell formation—and solved the question of how oyster shells are made. Locating and understanding this mechanism led to commercial applications.

In September 2013, the U.S. Patent Office granted a patent to Mount and the Clemson University Research Foundation (CURF). The patent enables CURF to license technology that could create ultra-tough materials for industry using some of the same techniques oysters have used for millions of years.

Today, Mount trains doctoral students and post-doctoral scholars in his laboratory using advanced optical- and electron-microscopy techniques. He also teaches a senior seminar course, focusing on the impacts of climate change, in particular ocean acidification and sea-level rise.

Along his 30-year career, Mount often turned to the Consortium for advice and recalls his early days working in the Charleston office.

"A diverse flow of scientists, professors, and experts from every corner of the oceanographic and marine biology community came through those front doors on Meeting Street," Mount says. "For me, it was a crucible for professional development and a window to the world of marine science."

— John H. Tibbetts

ANDREW S. MOUNT

B.S., Biology, University of Tampa, 1980

M.S., Marine Biology, College of Charleston, 1991

Ph.D., Zoology, Clemson University, 1999

First post-graduate job: Post-Doctoral Fellow, Clemson University, National Science Foundation Experimental Program to Stimulate Competitive Research

Current job: Associate Professor and Lecturer, Clemson University, Department of Biological Sciences

Sea Grant connection: Worked as Consortium graduate student intern, 1986-1989.

PEOPLE PERSON. *As a graduate student at College of Charleston, Robert Crimian worked on two Consortium-funded projects that examined how people's sense of place in locations such as Mount Pleasant's Shem Creek impact their views of the environment.* PHOTO/GRACE BEAHM

Understanding how people's sense of place impacts planning: Robert Crimian

Robert Crimian sees the natural world differently now. As an undergraduate marine science major at Coastal Carolina University, he was grounded in physical science. But when he studied for a M.S. in environmental studies at College of Charleston, his eyes opened to a different perspective that aids him in his professional life today.

Crimian participated in two S.C. Sea Grant Consortium-supported research projects examining how local people viewed their sense of place and well-being. The studies aimed to learn how local people placed themselves in the environment, what they valued most about their environment, and how they hoped their communities would look in the future.

Today, he travels the Georgia shore from the larger cities of Savannah and Brunswick to the coast's small towns and sea islands as the Southeast coast and ocean partnership coordinator at The Nature Conservancy's office in Darien, Ga. He spearheads a pilot project to create a framework for ocean planning along the Georgia coast. The key is to understand the sense of place in various

Among the places Crimian studied during his graduate years was the Noisette Creek section of Charleston County, where subsistence fishers share space with the remnants of industry.
PHOTO/GRACE BEAHM

regions and subcultures of the Georgia coast, from deep rural places to cities.

He interviews community leaders and stakeholders to learn how local people use waterways and other resources. Do they fish for recreation, for a living, or for their subsistence dinner? Or all of the above? Do some groups want conservation while others do not?

"We want to spatially see where a conflict might take place," he says, "so that if a conflict arises, it can be anticipated and possibly addressed."

Crimian learned the fundamentals of this work in 2012-2013 as a graduate research assistant for Susan Lovelace, then at the Hollings Marine Laboratory at Fort Johnson on James Island, S.C., and now assistant director for Development and Extension at the Consortium. Crimian performed coastal well-being data collection and analysis with Lovelace and Annette Watson, who studies human-environment geography at the College of Charleston. The researchers conducted a project titled "Coastal Livelihoods and the Local Sense of Place."

The researchers looked at three different populations—commercial, subsistence, and recreational fishers—in rural McClellanville, suburbanizing Awendaw, and urbanizing Mount Pleasant, all rapidly changing communities in northern Charleston County. Further growth is predicted along this corridor of U.S. 17 known as the "Sewee to Santee" region, which is the focus of an ongoing planning effort.

Crimian helped refine innovative social-science methods—interview techniques, quantitative analysis, and spatial tools—to measure local residents' well-being. He sought to quantify this well-being based on social, economic, and environmental indicators of different populations.

If groups of people have a lower economic well-being, do they value their surrounding environment more or less than other groups? The study showed residents of these three communities shared respect for the health of local waterways—a respect that transcended divisions of race or household wealth.

Crimian, who also worked on a well-being assessment project for populations along the Gulf Coast after the Deepwater Horizon oil spill, gathered skills along with data during that period.

"Although he was firmly grounded in marine science, he felt it was important to develop his knowledge of the human dimensions of the coastal environment," Lovelace says. "Working with me, Robert dove into sociological methods using secondary data to explore the social, cultural, and environmental quality of coastal communities. Then he pursued a deeper understanding of the perceptions about and knowledge of ecological restoration to different communities."

Working on those Consortium-funded research projects as a graduate student set him up ideally for his work with The Nature Conservancy.

"Before graduate school, I always thought about the coast from a biophysical standpoint," Crimian says. "But now I can see the social part of the equation. If we're going to solve problems, we need to stop thinking in silos and think more widely about social and ecological systems and how they interact."

— John H. Tibbetts

ROBERT CRIMIAN

B.S., Marine Science, Coastal Carolina University, 2011

M.S., Environmental Studies, College of Charleston, 2013

First post-graduate job: Compliance Project Manager, S.C. Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management

Current job: Southeast Coast and Ocean Partnership Coordinator, The Nature Conservancy

Sea Grant connection: Worked on Consortium-funded social science research project as a graduate student, 2012-2013.

Blazing a trail to improve marine education: Elizabeth Day-Miller

SCIENCE INTERPRETER. ***When Elizabeth Day-Miller was a Knauss fellow in 1999, she was an anomaly with a work history more focused on education rather than science, and her career since has melded teaching and scientific research.***
PHOTO/PROVIDED BY ELIZABETH DAY-MILLER

Elizabeth Day-Miller, with her ocean-science education focus, was unusual among the research and policy-dominated Knauss fellows in 1999. She hopes she was a trail blazer.

"I was definitely an anomaly for the Knauss fellowship program," Day-Miller says. "I was told there was discussion about whether it was appropriate to have someone with an education background serve as a Knauss fellow. Maybe I opened doors for people to be more involved in that way."

There's no doubting the positive outcome of Day-Miller's Knauss experience.

With a B.S. in marine science from the University of South Carolina and a M.S. in the same field from the State University of New York—Stony Brook, she already had experience working for the S.C. Sea Grant Extension Program, the Coastal Zone Education Center in Beaufort, S.C., and the Center for Science Education at the University of South Carolina.

As an extension agent, she helped start Beach Sweep/River Sweep, making presentations at schools in Horry and Georgetown counties and on local television to draw out nearly 1,500 volunteers to pick up litter along the beaches and waterways. She also was integral in Clemson's 4-H summer camp focused on marine resources, and she was part of the group that started the S.C. Marine Educators Association in 1988.

The Knauss fellowship allowed her to take that energy to Washington and the National Science Foundation (NSF) Division of Ocean Sciences. In a conversation with high-level administrators at NSF, she had the experience and the gumption to give her opinion on the best ways to improve ocean-science teaching in schools. Some thought the key was to write the perfect curricula and help provide the materials to the schools. Day-Miller thought too much emphasis was put on perfecting curricula, and more attention needed to be paid to helping teachers understand the science.

"Teachers would learn a lot by working with scientists, and scientists would learn a lot by working with teachers," Day-Miller says. "We needed to bring them together."

Day-Miller wasn't the only one thinking that way. Those conversations at NSF eventually led to the establishment of the Centers for Ocean Sciences Education Excellence (COSEE). The COSEE network, with a goal of fostering collaboration among research scientists and educators, grew to include 12 regional centers throughout the country. The Southeast center was based at the Consortium from 2001-2015, when grant funding for it ended.

After her Knauss fellowship, Day-Miller stayed on with NSF for a few months before moving on to a program analyst position with the

The emphasis on science education with a lab or research focus has taken hold at events such as the STEM Festival in Charleston, which draws thousands of eager youngsters each year.
PHOTO/GRACE BEAHM

National Sea Grant College Program office. In that role, she was instrumental in the design of the National Oceanic and Atmospheric Administration (NOAA) Environmental Literacy Grants Program.

Her emphasis throughout her career has been on the researchers and classroom teachers working together to improve everything they do. She has taught courses on the best ways to design ocean-science education programs.

Along the way, she developed expertise in writing proposals, designing projects, developing curricula, and evaluating proposals. Now she helps others with those tasks through her Bridgewater, Va.-based company, BridgeWater Education Consulting.

"I had the opportunity to support and influence many of the education initiatives that came out of NOAA," she says. "And all of that grew out of my Ph.D. work funded by Sea Grant and my work as a Knauss fellow."

— Joey Holleman

ELIZABETH DAY-MILLER

B.S., Marine Science, University of South Carolina, 1983

M.S., Marine Environmental Science, State University of New York—Stony Brook, 1987

Ph.D., Marine Science, University of South Carolina, 1999

First post-graduate job: Lab Technician, Food Web Analysis, University of South Carolina

Current job: Senior Education Consultant, BridgeWater Education Consulting

Sea Grant connection: Marine Extension Agent, 1988-1991; Graduate work funded by Consortium marine education grants; Knauss fellowship, 1999.

Providing the foundation that leads to stronger roofs: Edward Sutt

INNOVATOR. *While a graduate student at Clemson University in the 1990s, Edward Sutt played a role in S.C. Sea Grant Consortium-funded studies on how to improve the resilience of roofs during hurricanes and how to get builders to use the new methods.*
PHOTO/PROVIDED BY EDWARD SUTT

Homes being built along U.S. hurricane-prone coastlines structurally can handle high winds better today thanks in part to Edward Sutt's engineering work on S.C. Sea Grant Consortium-funded studies as a post-graduate student at Clemson University.

Smooth-shank nails were the roof fasteners of choice in the mid-1990s. With those nails offering little resistance, intense windstorms would rip off roof sheathing, cause a breach in the building, and, in the end, substantial property loss. The construction industry needed a better nail, and Sutt came up with a breakthrough design. His HurriQuake® nail received the 2006 "Innovation of the Year" award from the national magazine, *Popular Science*.

Two Consortium projects helped pave the way for the breakthrough.

After Hurricane Hugo struck in 1989, Consortium researchers surveyed damages to homes and found roofing materials often were inadequately secured to structures. Similar weaknesses were found in Florida after Hurricane Andrew in 1992.

One of the most effective ways to strengthen a structure for high winds, engineers learned, would be to improve attachments between the roof sheathing and roof framing as well as the roof-to-wall connection. Fasteners often were too weak to cope with intense wind pressures or were installed improperly.

"The problems [behind roof failures] became evident," Sutt says, "but it wasn't always clear how to solve these problems practically."

As a M.S. student at Clemson University from 1994 to 1996, Sutt studied methods to retrofit existing residential homes at these common failure points. Sutt's then-advisor at Clemson, Tim Reinhold, received support from the Consortium and other agencies to study how wood-frame structures functioned under forces associated with hurricanes at the Clemson Department of Civil Engineering's Wind Load Test Facility.

Sutt and Reinhold teamed with the S.C. Sea Grant Extension Program and others to develop a series of educational video guides for homeowners on how to retrofit roofs. "The idea," says Sutt, "was to hasten the process of getting information to homeowners and encourage improvements in buildings. The question was: We'd learned

Sutt designed a better roof fastener, the HurriQuake® nail, that was as easy to install as a nail but featured the stronger connection of a screw.
PHOTO/GRACE BEAHM

something in the lab. Now how can we get it out to people so it can be used?"

At the Clemson wind lab, meanwhile, Sutt was studying the relative strength of various fasteners. It turned out screws were usually stronger than smooth-shank nails. But screws were more expensive and required more time to install because they need to be "twisted" into the wood rather than "shot" with nail guns.

After receiving his M.S. in civil engineering, Sutt spent two years in industry before returning to Clemson from 1998 to 2000 for his doctorate to undertake research supported by the Consortium. He began developing the idea of a hybrid fastener with the greater strength of a screw but the lower costs and installation ease of a nail.

After completing his doctorate, Sutt went to work for Bostitch, a division of Stanley Black & Decker, where he deployed his Clemson lab experience to design an improved construction fastener. This hybrid nail was made of carbon-steel alloy with a wider head, a twist below the nail head to fill the space created by rings, and deep rings that hold the shaft firmly in the frame. The nail provided up to two times the resistance over conventional smooth-shank nails to high winds for the roof sheathing connection.

"Ed came to Clemson with an undergraduate education in engineering and a wealth of practical experience from building a home himself and being exposed to design and construction from a father who was an architect," Reinhold says. "While this foundation helped shape a practical approach to problem solving, it was clear that he also had a very inquisitive mind and was constantly looking for new and better ways to attack problems and to develop creative solutions."

Sutt has since guided numerous new fasteners through the research-and-development process. Now vice president of Fastening Systems at Pleasanton, Calif.-based Simpson Strong-Tie, he decides which potential products should go forward in the pipeline to customers. Sutt credits the Consortium for much of his success.

"Now I'm an expert in my field with an education that was basically due to Sea Grant," he says. "Sea Grant offered me a foundation. I was given a lot of latitude at Clemson to solve problems, and it allowed me a step-by-step growth, so I could arrive at the position that I hold today."

— John H. Tibbetts

EDWARD SUTT

B.S., Civil Engineering, Worcester Polytechnic Institute, 1990

M.S., Civil Engineering, Clemson University, 1996

Ph.D., Civil Engineering, Clemson University, 2000

First post-graduate job: Fastener Engineer, Stanley Black & Decker, Bostitch division

Current job: Vice President, Fastening Systems, Simpson Strong-Tie

Sea Grant connection: Worked on Consortium-funded research in both his M.S. and Ph.D. projects.

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For more information about S.C. Sea Grant Consortium fellowship opportunities, visit **www.scseagrant.org/Content/?cid=56**

NEWS & NOTES

Taylor re-elected as board chair

Col. Alvin A. Taylor
PHOTO/S.C. DEPT. OF NATURAL RESOURCES

Col. Alvin A. Taylor, director of S.C. Department of Natural Resources, has been re-elected chair of S.C. Sea Grant Consortium's Board of Directors. Taylor began his second one-year term on January 1, 2016. "I am pleased to continue working with the S.C. Sea Grant Consortium by supporting research, education, and outreach to conserve coastal resources and enhance opportunity for the people of South Carolina," said Taylor.

Taylor serves as the chief administrator for the state's natural resources agency with a staff of over 900 located across South Carolina. He graduated from Clemson University in 1976 with a bachelor's in zoology. He completed training at the U.S. Coast Guard Law Enforcement Training Center in Yorktown, Va., in 1976, and graduated from the S.C. Criminal Justice Academy in 1977.

"I look forward to working with Col. Taylor again this year in his role as board chairman," said Rick DeVoe, executive director of the S.C. Sea Grant Consortium. "His leadership has been instrumental to the Consortium as we seek to further advance our programmatic efforts."

S.C. Sea Grant Consortium highly rated by National Site Review Team

A National Sea Grant Site Review Team visited the S.C. Sea Grant Consortium on September 1-2, 2015. The purpose of the site visit was to evaluate our Sea Grant program's management and organization, stakeholder engagement, and collaborative network activities. The Consortium was highly rated by the Site Review Team (SRT), which determined the Consortium meets the "standards of excellence" expected of all Sea Grant programs.

The SRT praised the Consortium as being the go-to agency in the state for coastal and ocean information and assistance, for developing a huge reservoir of involved stakeholders, and for serving as a neutral party capable of brokering solutions to issues. Particular commendation went to Consortium Executive Director Rick DeVoe and his staff for their ability to build partnerships that integrate research, outreach, and education on coastal issues. According to the SRT, the consortium model—while not typical for Sea Grant programs—is extremely effective and creates a culture of collaboration to address the needs of stakeholders within the state and Southeast region in partnership with other organizations.

The SRT also applauded the Consortium for stepping up when federal support was eliminated for the highly successful Centers for Ocean Sciences Education Excellence. The Consortium filled that void in South Carolina with projects such as "From Seeds to Shoreline," a student-driven salt marsh restoration education effort, as well as a new Amazing Coasts curriculum aligned to South Carolina standards for grades three through five.

Three Best Management Practices (BMP) were identified by the Site Review Team. One was for the "study groups" initiative in which small grants were used to fund integrated teams to work on practical, emerging issues for the benefit of local communities. The teams consist of a Consortium extension specialist, a graduate student, a researcher, and a community organization member.

Another BMP is the Consortium's visioning exercise, currently underway, which is engaging a diverse group of stakeholders to discuss what they foresee the future to be like 20-30 years from now. Of particular importance is how the Consortium should position itself to remain relevant and responsive to the needs of our stakeholders in areas such as technology, economic development, and societal changes in population and diversity.

The third BMP cited was the development of the S.C. Coastal Information Network, which brings together outreach professionals from 18 organizations and works in "an atmosphere that escapes the notion of

NEWS & NOTES

competition, focuses on collaboration, and avoids duplication of effort," according to the SRT.

To read the National Sea Grant Site Review Report, which contains the Consortium's Briefing Book as an addendum, visit www.scseagrant.org/Content/?cid=831.

Sea Grant celebrates 50-year anniversary

An inspiration popped into the bright mind of oceanographer Athelstan Spilhaus in 1963, and he shared it just a few hours later at the 93rd meeting of the American Fisheries Society. Ocean and coastal researchers, he said, should come up with their own version of the land grant college model that had been so successful in taking academic-based agricultural research from colleges into the fields.

Thus began an effort that bore fruit three years later when Congress passed the National Sea Grant College Act, designed to unite the academic power of the nation's universities with public and private sector partners. Fifty years later, the 33 Sea Grant programs support work in Puerto Rico, Guam, and every state that has an ocean or Great Lakes coastline.

The 33 programs, including the S.C. Sea Grant Consortium, work together and with their partners to encourage productive and sustainable use of coastal and marine resources. They not only perform research on topics such as fisheries management and land use but also transform the results into real-world applications through educational programs that range from grade-school curriculum materials to training sessions for coastal planners and the marine industry.

Spilhaus, who passed away in 1998, was a prolific inventor of everything from children's toys to complex oceanographic measurement equipment. But none of those have had, or will continue to have, the impact of his notion that led to the Sea Grant College Program. Visit seagrant.noaa.gov/50thAnniversary.aspx to learn more about the history and accomplishments of Sea Grant.

DeVoe inducted into The Citadel's Academy of Science and Math

S.C. Sea Grant Consortium Executive Director Rick DeVoe was inducted into The Citadel's Academy of Science and Mathematics in a March 17 ceremony at the Francis Marion Hotel in Charleston.

The Academy induction recognizes alumni and non-alumni who play major roles in the research and educational accomplishments of The Citadel's School of Science and Mathematics. DeVoe was honored for his work at the Consortium, which supports research and outreach through eight member institutions, including The Citadel, and the agency's staff. DeVoe has been the Consortium's executive director since 1997.

Lok C. Lew Yan Voon, dean of the School of Science and Mathematics, presented an award to Rick DeVoe, executive director of the Consortium.
PHOTO/THE CITADEL

The Consortium has provided more than $225,000 in competitive grants and development funds to The Citadel for coastal research, education, and undergraduate training. The grants have allowed the school's faculty members to study toxicology, rice field impoundments, and microplastics in the environment.

The Consortium also has provided startup funds and assisted faculty in establishing the networks and partnerships that fuel careers. In addition, the Consortium recently announced its support for the new Citadel Undergraduate Research Experience.

DeVoe was inducted into the Academy in the non-alumnus category. He was joined in the 2016 class by faculty inductee Dena P. Garner, an associate professor of exercise science and associate director of the Honors College, as well as alumni inductees Dr. William H. Bowers, an orthopedic surgeon who recently joined the faculty at the Medical University of South Carolina, and Dr. J. Patrick Johnson, a neurosurgeon from Dixon, California.

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S.C. Sea Grant Consortium
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Charleston, S.C.
29401

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EBBS & FLOWS

National Marine Educators Association Conference

Orlando, Florida
June 25-July 1, 2016

Nearly 500 educators from high schools, public aquariums, non-profit organizations, and government agencies come together for five days of learning and sharing. Working around the theme "Making Waves: Current Connections in Marine Science," the conference will cover topics that promote awareness and education about the global marine environment. For more information, visit www.marine-ed.org/?conferences.

Carolinas Climate Resilience Conference

Charlotte, North Carolina
September 12-14, 2016

Researchers and staff from public agencies will share information about climate-related tools and resources in the Carolinas. Learn how communities are adapting to climate change, how professionals are translating the science to help mainstream audiences understand, and how the changes could impact public health, tourism, recreation, and natural resource management. Visit www.cisa.sc.edu/ccrc for more information.

S.C. Water Resources Conference

Columbia, South Carolina
October 12-13, 2016

This two-day forum examines water policies, management, and research with the goal of ensuring South Carolina has sufficient water resources to boost the economy and protect natural resources. Political and industry leaders, regulatory agencies, and non-profit organizations will make presentations, and case studies will be featured about the impact of the October 2015 floods on water resources and ecosystems. For more information, visit www.clemson.edu/public/sc_water_resources/index.html.

Subscriptions are free upon request by contacting: Annette.Dunmeyer@scseagrant.org

ATTENTION SCHOOL TEACHERS! The S.C. Sea Grant Consortium has designed supplemental classroom resources for this and past issues of *Coastal Heritage* magazine. *Coastal Heritage Curriculum Connection*, written for K-12 educators and their students, is aligned with the South Carolina state standards for the appropriate grade levels. Includes standards-based inquiry questions to lead students through explorations of the topic discussed. *Curriculum Connection* is available online at www.scseagrant.org/education.